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ABSTRACT

This study examined how constructivist teaching and the organization of the learning environment relate to student achievement. The researchers used structural equation modeling (SEM) to examine the relationships among school and teaching attributes and student achievement in reading, writing, and mathematics as measured by the Washington Assessment of Student Learning (WASL). Data came from the average school-level scale scores of 79,494 students and from questionnaires completed by 4,307 teachers from 239 elementary, middle/juniors, and high schools in Washington state. The analyses show a strong positive relationship between school attributes and constructivist teaching. Schools that emphasize parental and community involvement and that have teaching staff who model and expect responsible behavior and mutual respect are more likely to have staff who use constructivist teaching methods. Constructivist teaching appears to have a meaningful influence on student achievement as measured by the WASL. Findings also show structural relationships among many school and classroom factors and student achievement. Maximizing achievement appears to be the result of an environmental shift in the school, a reinvention of education. (Contains 4 figures and 19 references.) (SLD)

Washington School Research Center

Technical Report #4 – November 2002

The Relations Among School Environment Variables and Student Achievement: A Structural Equation Modeling Approach to Effective Schools Research

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The Washington School Research Center (WSRC) is an independent research and data analysis center within Seattle Pacific University. The Center began in July 2000, funded through a gift from the Bill & Melinda Gates Foundation. Our mission is to conduct sound and objective research on student learning in the public schools, and to make the research findings available for educators, policy makers, and the general public for use in the improvement of schools. We believe that sound data and appropriate data analysis are vital components for the identification of school and classroom practices related to increased student academic achievement.

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A Technical Report For
The Washington School Research Center

Washington School Research Center

Foreword

In the year 2000 the Bill & Melinda Gates Foundation announced a multi-million dollar initiative in the state of Washington to improve student learning in schools. The challenge before school personnel was to bring their schools and classroom instruction in line with attributes believed to be important for student success. During the first year of the initiative the Washington School Research Center was involved in the baseline assessment of grantee schools in relation to these school and classroom attributes. The data from that assessment are used in this report.

Specifically, this study "examines how constructivist teaching and the organization of the learning environment relate to student achievement." These constructs are based on the foundation's attributes of high achievement schools and the evaluation design for the Washington State projects. The researchers used structural equation modeling (SEM) to examine the relationships among school and teaching attributes and student achievement in reading, writing and mathematics as measured by the Washington Assessment of Student Learning (WASL).

Their analyses show a strong positive relationship between school attributes and constructivist teaching. Specifically, "Schools that emphasize parental and community involvement and that have teaching staff who model and expect responsible behavior and mutual respect are more likely to have staff who use constructivist teaching methods." The analyses also show that "school environment and partnerships affect student achievement indirectly through constructivist teaching." Further, constructivist teaching "appears to have a meaningful influence on student achievement" as measured by the WASL.

But these findings also show that there are "structural relationships" among many school and classroom factors and student achievement; that is, these attributes appear to work together to explain student achievement. This suggests that maximizing student achievement is not just a result of improved teaching, or of partnerships, or of focusing on respect and responsibility. Rather, these elements appear to be a part of a larger environmental shift in the school, one that has sometimes been referred to as "reinvention."

These results will be of particular interest to the foundation and its grantees, but the results are equally instructive to all Washington schools that are attempting to meet the state's expectations for reform and to have all their students meet higher academic expectations.

Jeffrey T. Fouts
Executive Director
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Introduction

Identifying factors related to 'effective schools' has become an important research focus among educational practitioners and others dedicated to student learning. Evaluations such as those funded by the Bill & Melinda Gates Foundation seek to discover which elements and processes in the educational setting are most influential in student achievement (Fouts & Associates, 2001). These attempts broaden the question of 'what works best' to include the evaluation of all features of the educational setting, not simply specific curricula or demographic characteristics of the student. In addition, recent technological advances such as new web-based programs (e.g., "Just for Kids" in Texas and other states) facilitate researchers' ability to conduct more sophisticated comparative analyses of school-level achievement while accounting for traditional factors thought to present barriers to learning such as poverty, student mobility, and limited English proficiency.

The identification of educational processes that best facilitate student learning will have a number of benefits. Not only will this kind of research aid in the development of new methods for enhancing student learning, but also on a more practical level it may help to ensure continued funding for individual schools. President Bush recently signed educational legislation requiring annual, public school testing in grades three through eight in mathematics and reading. Although it may take several years for this legislation to be implemented, future school-level funding will be affected by student achievement performance, the new litmus test for system level reform efforts in education.

This Technical Report presents data from a statewide study on effective educational practices in an attempt to clarify the relations between school environment variables and student achievement. More specifically, the study examines how constructivist teaching and the organization of the learning environment relate to student academic achievement. The findings presented in this report provide additional insight into the question of what works best to ensure demonstrable student learning.

Related Research Literature

Previous research suggests that student achievement is associated with a number of school characteristics. The five most commonly mentioned characteristics are an emphasis on teaching basic skills, high expectations for student achievement, frequent evaluation of student progress, a safe and orderly school climate, and educational leadership (Reynolds, Bollen, Creemers, Hopkins, Stoll & Lagerweij, 1996). Collaborative leadership between teachers and administrators also positively influences student achievement (Wong, Hedges, Borman & D'Agostino, 1996).

Green (2001) recently suggested, "a new spirit of cooperation and collaboration was emerging" (p. 739) in schools that have successfully developed standards, assessments, and accountability measures as a part of district-wide reform efforts. Teachers in these

schools are viewed as collaborators in problem solving, as opposed to relying on leadership at the district level to solve problems. Green also noted that ethical and moral behavior of staff was emphasized, and that there was a distinct climate of trust and respect among educators.

Additional research has supported a learner-centered, constructivist approach to teaching (McCombs, 1998). This approach encourages students' active engagement in academic material, questioning, experimenting, reflecting, discussing, and creating personal meaning (Smith, 1999). Capraro (2001) and Ziegler and Yan (2001) found that students taught by teachers who were high in constructivist beliefs (i.e., allowing students opportunities for meaningful exploration and discourse) had better problem-solving skills than students taught by teachers with low constructivist beliefs.

Recent thinking on educational reform also has supported a learner-centered, constructivist approach to education. Robinson and Sink (2002) noted:

> ...educational reform literature continues to advocate that the profession restructure the schooling process from a teacher-centered approach to a learner-centered perspective, focusing on the qualitative experiences, interests, talents, backgrounds, and needs of individual students, as well as how learning, motivation, and achievement can be promoted in every learner (see McCombs & Whisler, 1997 for detailed discussion of this movement). . . .It is important that what students learn...have personal meaning and relevance; activities that are perceived by students as having some relation to their own personal interests, needs, or goals are likely to motivate them toward greater involvement in the learning process (McCombs, 1998). . . .McCombs (1998) emphasized the importance of talking and listening to students, showing respect for students' diverse voices and perspectives, modeling social responsibility for students, and being a co-learner with students. She also suggested that the responsibility for learning is shared between students and educators. The educator doesn't simply deliver curriculum, but rather designs opportunities for students to learn, assessments that encourage student reflection and input, and activities that are individualized to the needs and abilities of students. Students and educators work collaboratively in the learning process. (p. 2-11)

Additionally, Donovan, Bransford and Pellegrino (1999) highlighted three research findings related to effective learning:

1. Because students come to the classroom with preconceptions about how the world works, educators must employ strategies that support students' individual meaning making.
2. To develop competence in an area of learning, students must have both a deep foundation of factual knowledge and a strong conceptual framework.
3. Strategies can be taught that allow students to monitor their understanding and progress in problem solving. (p. 2)

Simply stated, these findings support a constructivist approach to education and learning; one that supports students' individual meaning making, in-depth learning and understanding, and metacognition (i.e., students' thinking about thinking).

Donovan et al. (1999) noted that such an approach has implications for teachers. Students cannot be viewed as *tabula rasa*; teachers must strive to reveal the preconceptions students bring to the classroom and understand how these perceptions influence current learning. Teachers must use assessments that do more than simply ask students to repeat information; rather, assessments should uncover students' deep understanding of the material. Donovan et al. cautioned, however, that such deep understanding couldn't be obtained in all topics. Educators must allow for some topics to be covered superficially so that others may be covered in-depth. The authors also noted the importance of teaching metacognitive skills throughout the curriculum (e.g., students thinking about *how* they got their answer). In short, Donovan et al. emphasized that when teachers work with the students' preconceptions, teach some subject matter in-depth while providing a foundation of factual knowledge and teach metacognitive skills throughout the curriculum, student achievement improves.

Donovan et al. (1999) also noted that it is important that both the school and classroom environments be learner-centered. Teachers need to be aware of students' cultural and learning differences and how these differences affect their ability to perform in the classroom. In addition, they suggested that, "...attention must be given to what is taught (information, subject matter), why it is taught (understanding), and what competence or mastery looks like" (p. 21).

Similarly, the Bill & Melinda Gates Foundation has identified what it refers to as attributes of high achieving schools (Fouts & Associates, 2001). These include:

1. Common Focus: In high achieving schools, the staff and students are *focused* on a few important goals. The school has adopted a consistent research-based instructional approach based on shared beliefs about teaching and learning. The use of time, tools, materials, and professional development activities are aligned with instruction.
2. High Expectations: In high achieving schools, all staff members are dedicated to helping every student achieve state and local standards; all students are engaged in an *ambitious* and rigorous course of study; and all students leave school prepared for success in work, further education and responsible citizenship.
3. Personalized: In high achieving schools, the school is designed to promote powerful, sustained student relationships with adults where every student has an adult advocate and a *personal* plan for progress. It is vital that schools are small, intimate units of no more than 600 students (less than 400 strongly recommended) so that staff and students can work closely together.
4. Respect and Responsibility: In high achieving schools, the environment is *authoritative*, safe, ethical, and studious. The staff teaches, models, and expects responsible behavior and relationships are based on mutual respect.
5. Time to Collaborate: In high achieving schools, staff has time to *collaborate* and develop skills and plans to meet the needs of all students. Parents are recognized

as partners in education. Partnerships are developed with businesses in order to create relevance and work-based opportunities and with institutions of higher education to improve teacher preparation and induction.

6. Performance Based: In high achieving schools, students are promoted to the next instructional level only when they have achieved competency. Students receive additional time and assistance when needed to achieve this competency. Data-driven decisions shape a *dynamic* structure and schedule.
7. Technology as a Tool: In high achieving schools, teachers design engaging and *imaginative* curriculum linked to learning standards, analyze results, and have easy access to best practices and learning opportunities. Schools publish their progress to parents and engage the community in dialog about continuous improvement. (p. 3)

Method

Data utilized in this study were aggregated at the school level from two sources: achievement scores from the Washington State Office of the Superintendent of Public Instruction (OSPI) in Washington and questionnaire data ("Teacher Perspectives Questionnaire") from the Washington State District Grant Project (Fouts & Associates, 2001). The reading, mathematics, and writing achievement data represent the average school-level scale scores of 79,494 students who were given the Washington Assessment of Student Learning (WASL) in Grade 4 in 2000.

Teachers representing sixteen public school districts in Washington completed the Teacher Perspectives Questionnaire that focused on their school in relation to district, school, and classroom components of the "Seven Attributes of High Achievement in Schools," identified by the Bill & Melinda Gates Foundation (Fouts & Associates, 2001). Respondents were 4,307 teachers from 239 elementary, middle/junior, and high schools in Washington State. Schools varied from small and rural to large and urban, with an average size of 573 students. Poverty, as measured by the percent of students eligible for free or reduced lunch, ranged from 0% to 91%, with an average of 39%. Students in these schools were also ethnically diverse, with an average of 68% White, 10% Asian, 10% African-American, 9% Hispanic, and 3% Native American. The present study included teacher questionnaire data only from those schools with grade 4.

As part of the Washington State District Grant Project, responses to the Teacher Perspectives Questionnaire addressing school characteristics and teaching methods (50 items) were subjected to principal components factor analysis (with varimax rotation, N=3,964). The nine factors extracted (summarized in Table 1) were found generally to reflect the attributes of high achieving schools (Fouts & Associates, 2001).

A major factor that emerged from the TPQ was the Constructivist Teaching Scale, which had 12 items with factor loadings ranging from .53 to .74 and an internal reliability coefficient (α) of .92. A validation study of the scale was conducted six to nine months after the administration of the TPQ as part of a classroom observation project in Gates

Table 1

Teacher Questionnaire Items and Factor Analysis Results

Constructivist Teaching (alpha = .92)

Items:

1. Student work shows evidence of understanding, not just recall.
2. Assessment tasks allow students to exhibit higher-order thinking.
3. Students apply knowledge in real world contexts.
4. Students are engaged in activities to develop understanding.
5. Students are presented with a challenging curriculum designed to develop depth of understanding.
6. Teachers utilize the diverse experiences of students to build effective learning experiences.
7. Students present to real audiences.
8. The learning focus is competence, not coverage.
9. Students are engaged in active participation, exploration, and research.
10. Students produce quality work products.
11. Teachers and students set learning goals and monitor progress.
12. Clear expectations define what students should know and be able to do.

Standards –based Teaching (alpha = .80)

Items:

1. The school has adopted a consistent research-based instructional approach based on shared beliefs about teaching and learning.
2. The staff and students are focused on a few important goals.
3. The use of time, tools, materials, and professional development activities are aligned with instruction.
4. Data-driven decisions shape structure and schedule.
5. Teachers design curricula linked to learning standards.
6. Staff members are dedicated to helping every student achieve state and local standards.

Personalization (alpha = .76)

Items:

1. The school is designed so that every student has an adult advocate.
2. The size of this school allows staff and students to work closely together.
3. Students have a personal plan for progress.
4. The school is designed to promote student relationships with adults.

Technology (alpha = .91)

Items:

1. Every staff member and student has access to: computer hardware
2. Every staff member and student has access to: basic software applications (i.e., word processing, database)
3. Every staff member and student has access to: internet connection
4. Every staff member and student has access to: technical support
5. Every staff member and student has access to: training and instruction

Environment (alpha = .84)

Items:

1. The school is an ethical environment.
2. The staff teaches, models, and expects responsible behavior.
3. Relationships are based on mutual respect.
4. The school is a safe environment.
5. The school is a studious environment.

Partnerships (alpha = .78)
Items:

1. Parents have many opportunities to get involved with school programs.
2. The school engages the community in discussion about continuous improvement.
3. Parents are recognized as partners in education.
4. The school makes learning results readily available to parents.
5. Partnerships are developed with businesses in order to create work-based learning opportunities.
6. Partnerships are developed with institutions of higher education to improve teacher preparation and instruction.

Quality of Education (alpha = .86)
Items:

1. All students leave school prepared for success in work.
2. All students leave school prepared for further education.
3. All students leave school prepared for responsible citizenship.
4. The school is known for its academic excellence.
5. All students are engaged in a rigorous course of study.

Teacher Input (alpha = .80)
Items:

1. Staff have sufficient input on decisions about school programs.
2. School leaders try to solicit input from staff on how to improve the instructional program.

Distributed Leadership (alpha = .86)
Items:

1. District leadership encourages continuous improvement of teaching and learning.
2. District leadership focuses the topic of visits, correspondence and meetings on student learning.
3. District leadership engages parents and community members in an ongoing conversation about helping all students achieve at high levels.
4. District leadership places top priority on literacy.
5. The school board, administration and employee representatives share a goal of helping all students achieve.

grantee schools (Fouts, Brown, & Thieman, 2002). In this study a classroom observation protocol was developed using items from the Constructivist Teaching Scale and theoretical constructs associated with "constructivist" or "authentic" instruction. Classroom observations were conducted in 34 of the schools that had administered the TPQ to determine the degree to which constructivist teaching practices were readily observable in the school. The scores from those observations were used to create an overall school score that was then correlated with the teachers' perceptions of the degree to which constructivist teaching practices were used in the school as measured by the Constructivist Teaching Scale of the TPQ. A significant correlation ($r = .4$, $p < .05$, uncorrected for restriction of range) was found between the two measures.

In the current study, we conducted path analysis using structural equation modeling (SEM) with EQS (Bentler, 1995) to test a model of the relations among school attributes and school level achievement in reading, mathematics, and writing. Although SEM cannot prove that the relations between variables are causal, it can evaluate whether observed patterns in the data are consistent with a specified causal model. SEM can also evaluate whether one model fits the observed relations among the variables better than another model.

Our use of EQS required the deletion of cases that had missing data for any of the variables used in the model. Out of a total 156 schools with both teacher questionnaire and student achievement data, 140 schools had complete data for the variables of interest and were included in the SEM analyses. Table 2 presents the means and standard deviations for the measured variables used in this study.

Table 2

Means and Standard Deviations for All Measured Study Variables

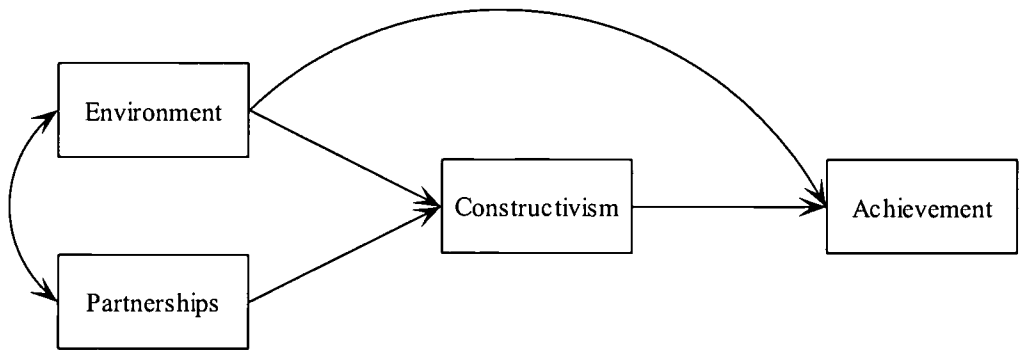
Variables	M	SD
Reading Scaled Score (RSCALE)	408.05	7.72
Math Scaled Score (MSCALE)	393.55	14.88
Total Percent Passed Writing (TOTWRI)	38.57	16.04
Environment (ENVIRO)	4.23	.34
Partnerships (PARTNE)	3.80	.31
Constructivist teaching (CONSTR)	3.84	.29

Results

The Structural Equation Models

The general hypothesized model tested in this study is presented in Figure 1. It contains four measured variables: school environment, partnerships, constructivist teaching, and student achievement (i.e., either reading, math, or writing scores). All measured variables are based on school-level data. For example, student achievement variables are based on the average achievement scores of students in each school using the Washington Assessment of Student Learning (WASL).[1]

Figure 1: General Hypothesized Model



Decisions about the inclusion of variables and paths within the model were guided by theoretical considerations. As noted in the literature review, many factors are related to students' academic success. On the other hand, a closer inspection of the factors derived from the Teacher Questionnaire indicated that a smaller number of factors could be used to represent the three distinctly different structural levels thought to influence student learning and each other (i.e., classroom-, school-, and community-level influences). The "constructivism" factor reflects classroom-level influences, i.e., the teaching methods used in successful schools. The "environment" factor represents school-level influences such as whether or not respect and responsibility are expected and modeled by school staff and whether the school is perceived as safe and studious. And finally, the "partnerships" factor reflects a much higher-order structural level including the extent to which parents and community are involved in the operation of the school.

The zero-order intercorrelations among all measured variables used in the model are presented in Table 3.[2] Two exogenous (i.e., predictor) variables in the model, school

[1] For more information on the WASL in Washington, visit www.k12.wa.us/assessment/WASLintro.asp and www.k12.wa.us/assessment/qawasl.asp.

[2]Because of a small sample size, 7th grade data could not be used with SEM in this study. However, it should be noted that the zero order correlations of the constructivist teaching scale with 7th grade reading,

environment and partnerships, represent school attributes thought to impact student achievement. Because of the strong positive relations between school environment and partnerships, covariances between these variables were estimated in the model.

Table 3

Zero-order Correlations for all Measured Study Variables (N=140)

	RSCALE	MSCALE	TOTWRI	ENVIRO	PARTNE	CONSTR
RSCALE	---	.89***	.76***	.46***	.36***	.44***
MSCALE		---	.76***	.44***	.38***	.45***
TOTWRI			---	.42***	.30***	.37***
ENVIRO				---	.67***	.78***
PARTNE					---	.79***
CONSTR						---

Note. RSCALE = reading scaled score, MSCALE = math scaled score, TOTWRI = total percent of children passing writing, ENVIRO = school environment, PARTNE = partnerships, CONSTR = constructivist teaching. *p<.05 **p<.01 ***p<.001

The structural model also contained two endogenous (outcome) variables: constructivist teaching and student achievement (e.g., student reading scores). Both exogenous variables were predicted to have direct and positive relationships with constructivist teaching. Both exogenous variables were also hypothesized to have indirect and positive effects on student achievement through constructivist teaching. In addition, a direct positive pathway between school environment and student achievement was specified. The pathways between partnerships and reading, math and writing scores were not specified due to functional differences in the level of each activity.

Criteria for Evaluating Model Fit. Evaluating causal models involves ascertaining how well the proposed model "fits" or adequately replicates the observed patterns between variables (Byrne, 1994). As is typical in evaluating SEM analyses, we used a number of different tests to assess different aspects of model fit (Pedhazur, 1997; Tabachnick & Fidell, 2001). Tests included the chi-square statistic, comparative fit index

math, and writing (.48, .56, and .35, respectively) were equivalent to those for 4th grade. In separate regression equations, constructivist teaching significantly predicted reading, math, and writing achievement scale scores.

(CFI; Bentler, 1990), and root mean square residual error of approximation (RMSEA). We also examined the standardized residuals for the average off-diagonal value and the largest off-diagonal value.

Chi-square is a statistic that tests the degree of misfit between the hypothesized model and a null model where all variables are assumed to be uncorrelated. With large samples, the null model provides a good baseline for comparing alternative models for an improvement in model fit. Significant values suggest that the covariance matrix associated with the hypothesized model does not replicate the underlying or observed covariance matrix structure. Thus, a non-significant chi-square indicates that the two matrices are not statistically different and that the hypothesized model fits the data (Schumacker & Lomax, 1996).

One problem with chi-square is that it tends to be overly sensitive to sample size. The comparative fit index (CFI) also compares a specified model to the null model but takes sample size into account (Byrne). CFI values range from 0.0 to 1.0 with values of .95 or higher indicating a good fit (Hu & Bentler, 1999).

Whereas chi-square and the CFI evaluate the hypothesized model relative to a null model, the root mean square error of approximation (RMSEA) indicates the lack of fit in a model compared to a saturated or perfect model (i.e., a model where all possible effects are specified). RMSEA is zero when a model is saturated and increases with greater model misspecification. Values of .06 or less indicate a good fit (Hu & Bentler, 1999).

The standardized residuals associated with a hypothesized model are also useful for assessing fit (Byrne, 1994). These should be small and evenly distributed when the model fits the data well. Of particular interest are the average and the largest off-diagonal residuals. The average residual indicates the overall degree of discrepancy in fit between the hypothesized and observed covariance matrices with larger values indicating greater discrepancy. Large residuals associated with specific parameters are related to some misspecification in the model and thereby affect the overall model misfit. For both of the latter indices, values approaching zero are desired.

SEM Analysis of the Hypothesized Model

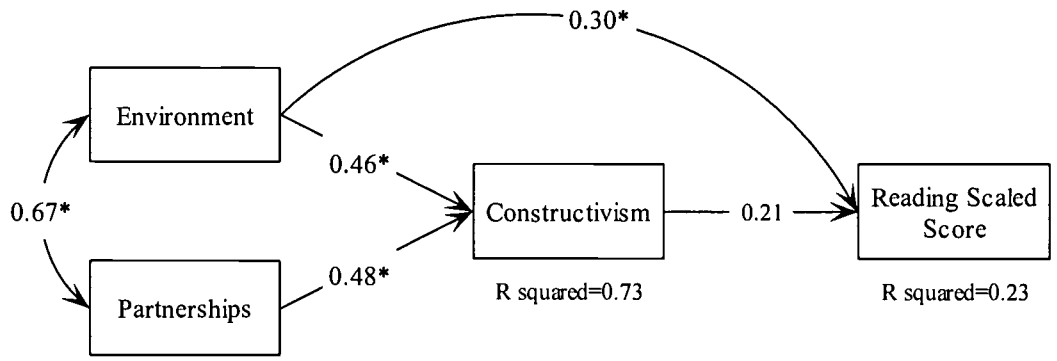
Models for predicting achievement in reading, math, and writing scores were evaluated separately to investigate how well the general model would fit these data. For reading scores, the overall hypothesized model was found to have a good fit to the data as indicated by a comparative fit index of 1.0; a chi-square (1, N = 140) of 0.01, p = .94; and a RMSEA of < 0.01. In addition, an examination of the standardized residuals indicated that the average off-diagonal value was .0006, which reflects a good fit to the data. The largest standardized residual was -.003 suggesting that there was very little misfit related to variables in the model.

With math scores as the criterion, the model also fit the data well with a CFI of 1.0, a chi-square (1, N = 140) of 0.02, p = .89, and RMSEA <.01. The average off-diagonal standardized residual was .001and the largest standardized residual was 0.006.

For writing, the CFI was 1.00, the chi-square statistic was 0.06, p = 0.80, and the RMSEA < .01. The average and largest standardized residuals were .002 and -.012, respectively.

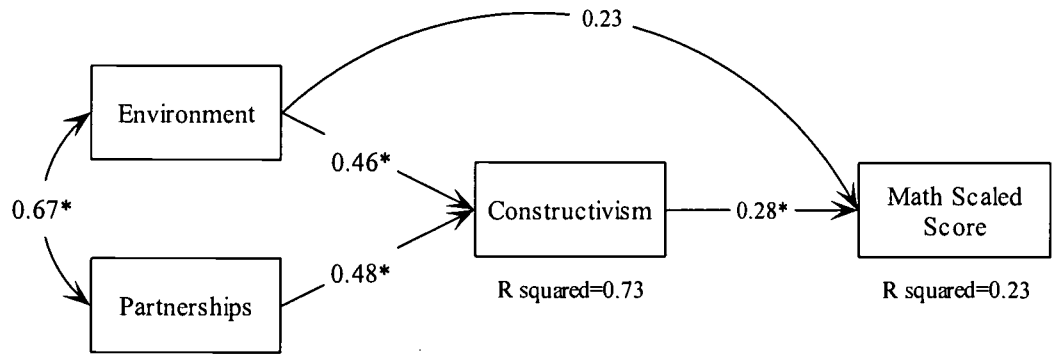
The standardized parameter estimates and significance levels for the structured paths among the observed variables in the three models are presented in Figures 2, 3 and 4. Pathways between the two predictor variables and constructivist teaching were all significant and positive. Together these variables accounted for 73% of the variance in constructivist teaching. Classroom environment was directly and positively related to children's achievement in reading and writing. School attributes and constructivist teaching accounted for 23% of the variance in reading scores and 18% of the variance in the percentage of children who passed writing. A significant direct and positive path was identified between constructivist teaching and student achievement in math. In contrast, pathways from constructivist teaching to student achievement in reading and writing were positive but not significant. It is also interesting to note that the direct pathways from school environment to reading and writing scores were both significant, however, the path from school environment to math scores was not significant. School attributes and constructivist teaching explained 23% of the variance in math scores.

Figure 2: The partial-mediation model for achievement in reading with standardized structural parameter estimates.



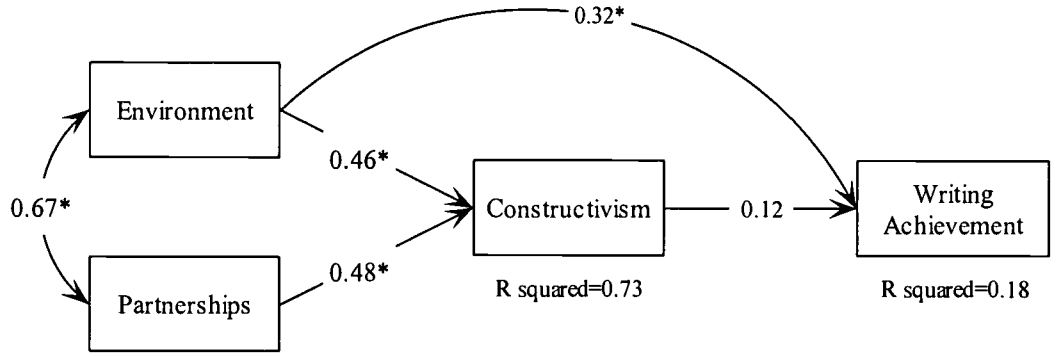
Chi sq. = 0.01, p =0.94, CFI=1.00, RMSEA = 0.00

Figure 3: The partial-mediation model for student achievement in math with standardized structural parameter estimates.



Chi sq. = 0.02, p =0.89, CFI=1.00, RMSEA = 0.00

Figure 4: The partial-mediation model for percentage of students passing writing with standardized structural parameter estimates.



Chi sq. = 0.06, p =0.80, CFI=1.00, RMSEA = 0.00

Discussion

The SEM analyses supported the hypothesis that school-level attributes have a meaningful impact on constructivist teaching and student achievement. Whereas not all attributes of high achieving schools (Fouts & Associates, 2001) were recognized in the final models, we confirmed that both "environment" and "partnerships" account for significant variance in teaching and student achievement.

The results are impressive in underscoring the relationships between school attributes and constructivist teaching. Although these are not causal attributions, a great deal of the variance in constructivist teaching is explained by the school attributes included in the current study. Schools that emphasize parental and community involvement and that have teaching staff who model and expect responsible behavior and mutual respect are more likely to also have staff who use constructivist teaching methods.

Equally impressive is the finding that school environment and partnerships affect student achievement indirectly through constructivist teaching. Although most clear in the case of math, constructivism appears to have a meaningful influence on student achievement. Thus, constructivist teaching may help to explain school-level reading, math, and writing WASL results.

A further important finding is the direct pathway from school "environment" to student achievement. Here, especially with reading and writing achievement, staff expectations regarding responsible behavior and mutual respect (among other things) are related to higher achievement scores. Thus, these elements of the learning environment directly influence student outcomes as well as the nature of the teaching.

Taken together, the findings from this study strongly support previous research on effective schools and student achievement. Furthermore, the analytic techniques used in this study helped to illuminate the structural relationships among school characteristics at multiple levels (i.e., the teaching methods, the school environment, and partnerships in the community) and student learning. The results of these analyses suggest that it is important for student achievement that learning is a parent/community matter, that staff model and expect appropriate behavior, and that the teaching actively engages students in curricula oriented to in-depth understanding.

Future research could profitably focus on comparative analyses of schools that attempt to develop these characteristics and those that do not. Although these types of studies are inherently problematic to arrange, the results would facilitate a better understanding of the dynamic relationships among school attributes and student achievement.

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